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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/986,919	11/13/2001	Jeawoan Lee	1567.1021	6274

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EXAMINER

TSANG FOSTER, SUSY N

ART UNIT PAPER NUMBER

1745

DATE MAILED: 08/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/986,919

Applicant(s)

LEE ET AL.

Examiner

Susy N. Tsang-Foster

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 June 2005.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-31 and 42-44 is/are pending in the application.
- 4a) Of the above claim(s) 13-31, 42 and 43 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-12 and 44 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 20050329.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submissions filed on 12/21/2004 and 2/15/2005 have been entered.

Election/Restrictions

2. Applicant's election with traverse of Group I, claims 1-12, and 44 in the reply filed on 6/3/2005 is acknowledged. The traversal is on the ground(s) that the Examiner's analysis does not reflect the features of claim 13 which require the specific features of claim 1 and that the claims of Group I and Group II are so closely related that they should remain in the same application since the Examiner's search would naturally encompass both technologies of Group I and Group II and that the beyond showing separate classifications in subclasses of the same class that the Examiner has not set forth sufficient evidence to show that the Examiner will experience a serious burden without imposing restriction. This is not found persuasive because claim 25 is an evidence combination claim which does not require the particulars of the subcombination of claim 1 for reasons given in the previous office action. See specifically MPEP 806.05(c), section III, " **SOME COMBINATION CLAIMS RECITE SPECIFIC FEATURES OF THE SUB-**

**COMBINATION BUT OTHER COMBINATION CLAIMS GIVE EVIDENCE THAT THE
SUBCOMBINATION IS NOT ESSENTIAL TO THE COMBINATION.”**

The restriction requirement in the instant application between combinations A and subcombination B falls under the category of AB_{sp}/AB_{br} Evidence Claim/B_{sp} stated in MPEP 806.05(c), section III.

Claim 25 is an evidence claim which indicates that the combination does not rely upon the specific details of the subcombination for its patentability. Therefore, where the combination evidence claim AB_{br} does not set forth the details of the subcombination B_{sp} and the subcombination B_{sp} has separate utility, the inventions are distinct and restriction is proper if reasons exist for insisting upon the restriction.

With respect to applicant's argument regarding the Examiner's burden, MPEP 808.02 states that the Examiner may restrict distinct invention if one of the following could be shown: (A) Separate classification thereof, (B) A separate status in the art when they are classifiable together or (C) A different field of search. The Examiner has shown separate classification which falls under criterion A. Furthermore, the electrode may be searched in the capacitor arts and in the sodium sulfur battery art which is not required or appropriate for searching the claims drawn to the lithium-sulfur battery. Thus, the Examiner has established burden under the criteria set forth in MPEP 808.02.

The requirement is still deemed proper and is therefore made FINAL.

3. Claims 13-31, 42, and 43 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention, there being no allowable generic or linking

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claim. Applicant timely traversed the restriction (election) requirement in the reply filed on 6/3/2005.

Information Disclosure Statement

4. The information disclosure statement filed on 3/29/2005 has been considered by the Examiner.

Claim Objections

5. Claims 3 and 4 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

In claim 3, the limitation "at least 80%" which encompasses 90% does not further limit claim 1 which recites "at or greater than 60% porosity and less than 90% porosity".

In claim 4, the limitation "at least 80 to 90% porosity" does not further limit claim 1 which does not include 90% porosity.

Claim Rejections - 35 USC § 112

6. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

7. Claims 1-12, and 44 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the

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relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

In claim 1, the limitation “a current collector having pores comprising at or greater than 60% porosity and less than 90% porosity based on an overall volume of said current collector” is not in the original disclosure. The numerical ranges in the original disclosure do not show that applicant possessed at the time the invention was made less than 90% porosity but greater than or equal to 60%. Furthermore, the original disclosure does not include any data to appreciate that less than 90% porosity is significant to applicant’s invention.

Claims depending from claims rejected under 35 USC 112, first paragraph are also rejected for the same.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 1-5, and 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chu et al. (US 6,030,720) in view of Peled et al. (US Pat. No. 4,410,609).

The product-by-process limitations of claims 5, 9, and 10 are not given patentable weight since the courts have held that patentability is based on a product itself, even if the prior art product is made by a different process (see In re Thorpe, 227 USPQ 964, (CAFC 1985), In re Brown, 173 USPQ 685 (CCPA 1972), and In re Marosi, 218 USPQ 289, 292-293 (CAFC 1983)).

In claim 5, the product by process limitation “wherein said porous current collector comprises a resin foam coated with a metal, where the coated resin foam is subjected to a pyrolysis process” is not given patentable weight in a product claim. Therefore, a porous metallic current collector would meet the claim limitation.

In claim 9, the product by process limitation “wherein the metal is coated using a coating method that comprises one of electroplating and electroless plating” is not given patentable weight in a product claim.

In claim 10, the product by process limitation “wherein the metal is coated using a coating method that comprises one of electroplating and electroless plating” is not given patentable weight in a product claim.

The present claims are drawn to a positive electrode comprising a sulfur based active material where the disclosed inventive concept appears to be a positive electrode porous current collector in which the sulfur based active material is disposed.

Chu et al. disclose a lithium sulfur battery comprising a positive electrode comprising a current collector that can be a conductive foam or a thin conductive grid such as a metal-coated polymer fibers or weaves in which the positive electrode material is interspersed throughout the

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matrix provided by the current collector (col. 9, lines 15-37 and Figures 2A and 2B).

Conductive foam or thin conductive grid such as a metal coated polymer fibers or weaves inherently are porous since they provide a matrix in which the positive electrode material is interspersed. The reference also states that the matrix is sufficiently "open" that there is room for precipitated electroactive material to deposit on the matrix (col. 10, lines 39-56). The positive electrode material is interspersed through the matrix provided by the current collector (col. 9, lines 27-30). Current collector materials may be made of a material such as aluminum that is resist to degradation in the electrochemical environment of the cell (col. 8, lines 13-34).

The positive electrode material may be elemental sulfur, sulfides, polysulfides, redox sulfur polymers (col. 6, lines 5-42 and col. 19, lines 6-15), and Li_2S_x where x is a value of 1 or greater (col. 9, lines 40-55). The positive electrode material may be interspersed into the current collector material by providing a slurry containing the sulfur based active material, a suitable binder, electroconductive agent, and solvent (col. 17, lines 24-40) and coating the slurry onto a porous current collector such as carbon fiber paper (col. 17, lines 30-35) where the carbon fiber paper is impregnated with the slurry and the solvent is evaporated (col. 23, lines 23-50 and col. 19, lines 45-58).

The negative electrode material may be lithium metal, lithium alloy, carbon based-lithium ion which reversibly intercalates and deintercalates lithium ions (col. 21, lines 1-46). A separator separates the positive electrode and the negative electrode and may be glass, plastic, ceramic, or a polymeric entraining liquid electrolyte (col. 8, lines 43-61). The battery contains a liquid electrolyte containing a lithium salt which impregnates (permeates) the negative electrode,

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positive, electrode, and separator (col. 14, lines 43-67 and col. 16, lines 1-6) and where the electrolyte also transfers lithium metal ions (col. 10, lines 1-6).

Chu et al. ('720) do not disclose that the current collector comprises at least 60% porosity and less than 90% porosity based on an overall volume of the current collector.

Peled et al. teach a lithium-sulfur battery comprising a positive electrode current collector that is porous and the porosity of the positive electrode current collector is advantageously about 80% or 75-90% (col. 4, lines 1-23).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have the porosity of the current collector of Chu et al. ('720) to be 80% porous because such porosity would provide a cathode with high porosity so as to allow extensive electrolyte solvent communication throughout the bulk of the cathode and improve ionic conductivity in the electrode and lead to improved battery performance.

10. Claims 1-5, and 9-12 rejected under 35 U.S.C. 103(a) as being unpatentable over Chu (US Patent No. 5,686,201) in view of Peled et al. (US Pat. No. 4,410,609).

The product-by-process limitations of claims 5, 9, and 10 are not given patentable weight since the courts have held that patentability is based on a product itself, even if the prior art product is made by a different process (see In re Thorpe, 227 USPQ 964, (CAFC 1985), In re Brown, 173 USPQ 685 (CCPA 1972), and In re Marosi, 218 USPQ 289, 292-293 (CAFC 1983)).

In claim 5, the product by process limitation “wherein said porous current collector comprises a resin foam coated with a metal, where the coated resin foam is subjected to a pyrolysis process” is not given patentable weight in a product claim. Therefore, a porous metallic current collector would meet the claim limitation.

In claim 9, the product by process limitation “wherein the metal is coated using a coating method that comprises one of electroplating and electroless plating” is not given patentable weight in a product claim.

In claim 10, the product by process limitation “wherein the metal is coated using a coating method that comprises one of electroplating and electroless plating” is not given patentable weight in a product claim.

Chu discloses a positive electrode containing active-sulfur based composite electrodes in a lithium sulfur battery (col. 1, lines 15-27 and col. 4, lines 29-60). The positive electrode comprises active sulfur (in the form of elemental sulfur in the examples provided in the reference), binder and a conductive agent such as carbon black (col. 5, lines 9-43). The current collector to which the positive electrode slurry is applied can be in the form of expanded metals, screens, meshes, and foams as is known in the art (col. 15, lines 3-20). The current collector can be made of aluminum, copper, titanium or other conductive material which would not react at operating cell conditions.

Peled et al. teach a lithium-sulfur battery comprising a positive electrode current collector that is porous and the porosity of the positive electrode current collector is advantageously about 80% or 75-90% (col. 4, lines 1-23).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have the porosity of the current collector of Chu et al. ('720) to be 80% porous because such porosity would provide a cathode with high porosity so as to allow extensive electrolyte solvent communication throughout the bulk of the cathode and improve ionic conductivity in the electrode and lead to improved battery performance.

11. Claims 6-8, and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chu (US Patent No. 5,686,201) in view of Peled et al. (US Pat. No. 4,410,609) as applied to claims 1 and 5 above, and further in view of Kawakami (US Patent No. 6,475,664).

Chu et al. ('201) as modified by Peled et al. disclose all the limitations of claims 6-8, and 44 except that the metal foam comprises a carbon conductive agent other than the metal, that the porous current collector comprises the non-woven fabric coated with a metal, or that the porous current collector comprises a carbon fiber.

Kawakami disclose that current collectors in the form of a metal foam for a positive electrode of a battery can be obtained by 1) coating the surface of a sheet-shaped organic polymer resin having a three dimensional network structure of urethane foam with a metal film of nickel or the like by means of plating or the like and subjecting the resultant to sintering to decompose and remove the polymer resin, or 2) obtained by coating the surface of a carbon

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fiber felt (which is a nonwoven fabric) with a metal film of nickel or the like by means of plating or the like and such current collectors efficiently supply an electric current consumed in or collect an electric current generated in the electrode reaction upon charging or recharging and are highly electrically conductive and inactive in a battery reaction (col. 13, lines 62-67 and col. 14, lines 1-14).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a metal foam as a current collector in the battery of Chu ('201) obtained by 1) coating the surface of a sheet-shaped organic polymer resin having a three dimensional network structure of urethane foam with a metal film of nickel or the like by means of plating or the like and subjecting the resultant to sintering to decompose and remove the polymer resin, or 2) obtained by coating the surface of a carbon fiber felt (which is a nonwoven fabric) with a metal film of nickel or the like by means of plating or the like because such metal foam current collectors efficiently supply an electric current consumed in or collect an electric current generated in the electrode reaction upon charging or recharging and are highly electrically conductive and inactive in a battery reaction.

12. Claims 6-8, and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chu et al. (US 6,030,720) in view of Peled et al. (US Pat. No. 4,410,609) as applied to claims 1 and 5 above, and further in view of Kawakami (US Patent No. 6,475,664).

Chu et al. ('720) as modified by Peled et al. disclose all the limitations of claims 6-8, and 44 except that the metal foam comprises a carbon conductive agent other than the metal, that the

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It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a metal foam as a current collector in the battery of Chu ('720) obtained by 1) coating the surface of a sheet-shaped organic polymer resin having a three dimensional network structure of urethane foam with a metal film of nickel or the like by means of plating or the like and subjecting the resultant to sintering to decompose and remove the polymer resin, or 2) obtained by coating the surface of a carbon fiber felt (which is a nonwoven fabric) with a metal film of nickel or the like by means of plating or the like because such metal foam current collectors efficiently supply an electric current consumed in or collect an electric current generated in the electrode reaction upon charging or recharging and are highly electrically conductive and inactive in a battery reaction.

Response to Arguments

13. Applicant's arguments filed 2/15/2005 and 12/21/2004 have been fully considered but they are not persuasive.

With respect to claims rejected under 35 USC 112, first paragraph, the applicant contends that the Examiner asserts that the range of at or between 60% and 90% is not contained in the original disclosure.

In response, the Examiner did not make such an assertion. Instead, the Examiner stated in the last Office Action (as reproduced above) that the limitation "a current collector having pores comprising at or greater than 60% porosity and less than 90% porosity based on an overall volume of said current collector" is not in the original disclosure. The numerical ranges in the original disclosure do not show that applicant possessed at the time the invention was made a range less than 90% porosity but greater than or equal to 60%. The original disclosure does not include any data to appreciate that less than 90% porosity is significant to applicant's invention.

With respect to claims 3 and 4, applicant asserts that the range of at least 60% porosity and the range of at least 80 to 90% porosity were originally presented.

In response, applicant appeared to have misunderstood that the Examiner objected to claims 3 and 4 as not further limiting claim 1 because at least 60% encompasses greater than 90% and at least 80 to 90% includes 90% whereas claim 1 does not include 90%.

With respect to art rejections based on Chu as modified by Peled, applicant asserts that the Examiner stated in the advisory action that the prior art reference to Imai provided

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motivation to combine Chu with Peled and that the Imai reference has a U.S. filing date that is after the foreign priority date.

In response, the Examiner does not need rely on Imai in the art rejections based on Chu as modified by Peled. The motivation to combine Peled with Chu as stated above is that the high porosity current collector of Peled allows extensive electrolyte solvent communication throughout the bulk of the cathode. It is also well known in the art that increased loading of the cathode active material would be achieved when the current collector is highly porous which would also increase cathode real surface area which in turn would greatly improve cell current density. As evidenced by Chottiner (US Patent No. 4,152,489), a 75% to 95% porous metal current collector can have between 45% to about 90% of its pore volume be filled with active material (See abstract) with increased battery power output.

Conclusion

Any inquiry concerning this communication or earlier communications should be directed to examiner Susy Tsang-Foster whose telephone number is (571) 272-1293. The examiner can normally be reached on Monday through Friday from 9:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached at (571) 272-1292.

The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications

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may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

st/



SUSY TSANG-FOSTER
PRIMARY EXAMINER